Calculation of Apparent Reflectance Using the MODTRAN2a Radiative Transfer Code

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ABSTRACT

We describe and validate an algorithm for the inversion of the radiance measured by the Airborne Visible-Infrared Imaging Spectrometer (AVIRIS) to apparent reflectance. This algorithm uses atmospheric parameters derived solely from the AVIRIS measured total upwelling radiance for each 20 meter spatial element . Atmospheric aerosol. scattering is calculated from a non linear least squares fitting (NLLSF) algorithm between the measured radiance and MODTRAN2a modeled radiance in the 400 to 700 nm spectral. region. Atmospheric water vapor is estimated from the 940 nm absorption band and a NLLSF MODTRAN2a driven model . Molecular scattering and absorption from well mixed atmospheric gases (carbon dioxide, oxygen and methane) is derived from the '/60 oxygen absorption band . These atmospheric parameters in conjunction with the absolute calibration of AVIRIS are used to compensate for illumination as well as atmospheric absorption and scattering for each spatial element in order to calculate the equivalent horizontal labertian reflectance of the surface. (Future work with digital elevation models will include compensation for the slope and azimuth of the surface.) This algorithm is validated with independently acquired surface reflectance measurements for a Spring and Autumn acquisition of AVIRIS radiance images over the ecological preserve at Jasper Ridge, California, This validation tests the algorithm for AVIRIS scenes with different illumination, water vapor and aerosols conditions. A research experiment for species-type identification at Jasper Ridge based on spectral signature from the AVIRIS calculated apparent reflectance is also presented.

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